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THE TEST AND EVALUATION EVOLUTION (RELATIVE TO THE U. S. AIR FO--ETC(U)
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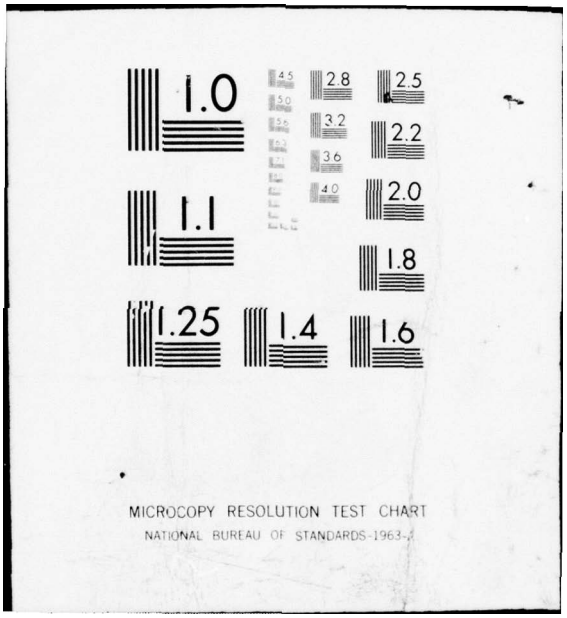
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DEFENSE SYSTEMS MANAGEMENT SCHOOL

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

THE TEST AND EVALUATION EVOLUTION
(RELATIVE TO THE U S AIR FORCE)

STUDY REPORT
PMC 74-1

William D. Bryden Jr.
Major USAF

FORT BELVOIR, VIRGINIA 22060

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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: THE TEST AND EVALUATION EVOLUTION (RELATIVE TO THE U S AIR FORCE)

STUDY GOALS: To trace the test and evaluation evolution through the last four years and to forecast its current direction.

STUDY REPORT ABSTRACT

The Blue Ribbon Defense Panel Report of July, 1970 provided the impetus for major changes in the structure and conduct of test and evaluation (T&E) in the Department of Defense. This report traces the actions taken by OSD, Air Force and Systems Command over the last four years up to the formation and implementation of the Air Force Test and Evaluation Center (AFTEC) in January of 1974. To ascertain the probable direction of T&E, several members of the T&E community were interviewed. The results of these interviews are presented and discussed. They indicate a uniform and stable policy throughout the Air Force and an increasing role of AFTEC in the T&E business as they become active and involved in the emerging programs. No major changes are anticipated in the current T&E policies and directives.

KEY WORDS: MATERIEL EVALUATION WEAPON SYSTEMS AIRCRAFT
BLUE RIBBON DEFENSE PANEL

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William D. Bryden, Jr.

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DATE May 1974

THE TEST AND EVALUATION EVOLUTION (RELATIVE TO THE U S AIR FORCE)

An Executive Summary
of a
Study Report
by

William D. Bryden Jr
Major USAF

May 1974

Defense Systems Management School
Program Management Course
Class 74-1
Fort Belvoir, Virginia 22060

The evolution of test and evaluation (T&E) policy, begun by the 1970 Blue Ribbon Defense Panel (BRDP) report, is impacting on all systems acquisition programs. It is imperative that today's program managers no longer view testing as an area to trade off when the dollar and time crunch come along. Awareness of congressional interest (PL-92-156), Office of the Secretary of Defense direction (DODD 5000.1 and 5000.3) and Air Force guidance (AF Reg 23-26 and AF Reg 80-14) is mandatory in the development of each new weapons system. It is the consensus of informed people in the T&E community that today's policies will be relatively stable over the next few years.

I recommend that each program office:

1. Track the current laws, directives and regulations concerning test and evaluation.

2. Provide detailed planning for all testing phases early in its program life cycle.

3. Include all concerned commands and agencies in all the planning phases.

4. Construct a test plan which will provide convincing proof that its system will do the mission it is designed to do.

5. Assure that sufficient numbers of its system are designed into its full scale development program to keep

the contractors' production and engineering personnel intact until IOT&E is complete and the production decision is made.

In today's environment you must sell each program through adequate and convincing testing.

THE TEST AND EVALUATION EVOLUTION
(RELATIVE TO THE U S AIR FORCE)

STUDY REPORT

Presented to the Faculty

of the

Defense Systems Management School

in Partial Fulfillment of the

Program Management Course

Class 74-1

by

William D. Bryden Jr
Major USAF

May 1974

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-Rear Admiral Forrest S. Peterson for his patient explanation of the Office of the Secretary of Defense involvement in the test and evaluation evolution.

-Colonel James Abrahamson for his guidance, continuing encouragement, and his unique insight to the changing test environment.

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CONTENTS

THE TEST AND EVALUATION EVOLUTION

(RELATIVE TO THE U S AIR FORCE)

Introduction

About 7,000 people showed up on the afternoon of July 30, (1909) which was less than usual. Rain showers discouraged many from making the trip because they knew that the Wrights never flew if the weather was unfavorable. About four o'clock it looked as though the sky was clearing and the wind was dying down. Orville told the board members he would be ready in about one hour and a half. Maj. Charles McK. Saltzman and Lieut. George C. Sweet, a Navy observer, quickly drove to Shooter's Hill with the field telephone to let us know when everything was ready there. The Wrights pushed their machine to the starting rail and made many adjustments to the engine and guy wires. I put two stop watches around my neck and got into the passenger seat. I strapped a box compass to my left thigh, lashed an aneroid barometer to my right thigh, and jammed a map into my belt.

Orville warmed up the engine until he was satisfied with it, and climbed aboard. "If I have any trouble", he shouted above the roar of the engine, "I'll land in a field or the thickest clump of trees I can find."

I nodded and gulped. I had picked a course with no fields of any kind en route. It was too late to do anything about it now, so I grabbed the edge of the seat with both hands and waited. Orville revved up the engine, released the trigger, and the machine started down the rail. We skimmed over the grass for a few feet to gain speed, and then climbed for altitude. As we started to circle, Wilbur ran to the center of the field below us with a stop watch in one hand and a signal flag in the other. We made two complete circles of the field, gaining altitude (125 feet), and then Orville swung sharply over the starting line.

I flicked one stop watch and pointed out the exact course we should follow to Shooter's Hill.

All twenty-five horses in the engine were functioning perfectly as we skimmed over the treetops toward the first balloon. The air was bumpy, and I had the feeling that there were moments when Orville didn't have full control of the machine as we dipped groundward. It was as if someone on the ground had a string attached to us and would pull it occasionally as they would a kite. But each time Orville would raise the elevators slightly, and we would gain back the lost altitude.

We reached Shooter's Hill all right, and I flicked the second stop watch. There was a crowd on the brow of the hill, and I could see them wave their umbrellas and handkerchiefs. It seemed to me that the angle of bank of the plane was awfully steep as we rounded the turn and the wing tip was much too close to the tops of the trees. A down draft hit us, and I thought we were going to cartwheel into them for sure. We straightened out, however, and started back for Myer. Going down wind now, our ground speed increased and Orville climbed until we reached 400 feet - a world's altitude record. As we neared Myer, Orville nosed down to pick up speed, and aimed at the starting tower. I flicked the stop watch off as we crossed the starting line and relaxed as he made a circle over Arlington Cemetery, cut off the engine, and glided in for a fairly smooth landing amid a cloud of dust.

Wilbur rushed up to us, and it was the first time I ever saw him with a smile on his face. I learned later that he had experienced some excruciating moments of doubt when we had disappeared below the level of the trees around the parade ground on our outward trip.

The crowd was larger when we landed than when we had departed. President Taft had not been present for the takeoff but had seen us land, and sent a messenger through the crowds to us with a note of congratulation. I had the feeling, though, that some of the citizens present were disappointed. From my experience with the crowds that had witnessed the

previous test flights, I had no doubt that many of them were disappointed that we had not landed in Arlington Cemetery and thus provided them with a real old-fashioned Roman holiday with all the bloody trimmings.

As soon as the board members could get together, we compared our stop watches and determined that the official speed to Alexandria had been 37.735 miles per hour; on the return trip it was calculated at 47.431 miles per hour, with the average officially computed at 42.583 miles per hour. Major Squier asked the Wrights if they wanted to make another trial since the specification allowed them three chances. They replied that they would stand on this, their first cross-country flight.

Since they had flown more than 42½ miles per hour, it was thought that they would be eligible to collect a bonus of $7,500; however, some government lawyer disallowed the fraction above the 42 miles per hour and they qualified for only $5,000 above their bid price of $25,000. On August 2, 1909, Aeroplane No. 1 was officially accepted into the inventory of the United States Army. (35:63-65)

With this flight, as aptly described by Benjamin Foulois, the first aircraft test and evaluation program was successfully completed. A new era was begun - military aviation. This also marked the beginning of military test and evaluation of aircraft. That policies and procedures have changed is obvious to anyone even slightly aware of today's methods of systems acquisition. What may not be as obvious are the changes that have occurred in just the last four years and that continue to occur. My purpose here is to trace the recent evolution of test and evaluation, where

appropriate, limiting the scope to the U S Air Force, and further to aircraft testing.

In the next section of this paper I will review recent guidance and directives to bring you up to date. Following this analysis of the current state, the next two sections will address the direction of test and evaluation in the future. First by revealing the results of numerous interviews and then by analyzing and interpreting this information.

Before continuing, I want to draw your attention to Appendix A where you will find a glossary of terms defined as they are used in the test business. Unless you are on speaking terms with the current T & E terminology, you will find this a few minutes well spent.

REVIEW OF LITERATURE

Aircraft testing has been with us since the acceptance of Aeroplane No. 1, as described in the introduction, but the how, what and who of this testing have changed as drastically as the aircraft's speed and altitude have. In today's environment of fewer dollars and the high rate of change of our technical capability, testing has gained a new role of importance. To understand both the reasons for and the implications of this role I find it most helpful to review, in brief, the documents, reports, directives, regulations and policy guidance in the order in which they appeared. Table I is a chronological listing of the major documents beginning with the Blue Ribbon Defense Panel (BRDP) report in July of 1970 up through the draft revision to Air Force Regulation 80-14, "Test and Evaluation".

Although there is some record of concern over test and evaluation (T&E) policy and procedure prior to the BRDP report it undoubtedly provided the major thrust behind the changes that have taken place over the last four years and that are continuing today. This group of high level men took an in-depth look at all phases of the operation of the Department of Defense at the request of President Nixon. A synopsis of their findings in the area of Operational Testing and Evaluation (OT&E) is as follows:

Functional testing (often called engineering testing) is done to determine how well various systems and materiel ... meet technical requirements.

By and large, functional testing in and for the Department of Defense appears to be well understood and faithfully executed. ... Functional testing is not considered to be a major problem area.

Operational testing, on the other hand, is done to determine to the extent possible whether such systems and materiel can meet operational requirements.

There has been an increasing desire, particularly at OSD level, to use data from OT&E to assist in the decision-making process.

Unfortunately, it has been almost impossible to obtain test results which are directly applicable to decisions or useful for analyses. Often test data do not exist. When they do, they frequently are derived from tests which were poorly designed or conducted under insufficiently controlled conditions to permit valid comparisons.

The most glaring deficiency of OT&E is the lack of any higher-than-Service organization responsible for overseeing Defense OT&E as a whole.

There are three principal problems with Air Force OT&E, as currently done. First, operational considerations receive much too little attention in Categories I and II. Second, the operational commands responsible for Category III and Operational Employment Testing lack both the personnel and facilities to be effective. Finally, all of the categories are too duplicative and time-consuming.

Currently, there is no effective method for conducting OT&E which cuts across Service lines, although in most actual combat environments, the United States must conduct combined operations.

> Funding throughout the Department of Defense has been and continues to be inadequate to support much necessary OT&E. ... In fact, there is no agency that can even identify the funds that are being spent on OT&E. (3:88 to 91)

As a result of these findings the BRDP made the following three recommendations:

> The responsibility for Defense Test and evaluation policy should be assigned to the Assistant Secretary of Defense (Test and Evaluation).
>
> A separate program category should be established for Test and Evaluation.
>
> The responsibility for overview of Defense test and evaluation effort should be assigned to the Defense Test Agency. In addition, the Agency should be responsible for design or review of test designs, performing or monitoring of tests, and continuous evaluation of the entire test and evaluation program. (3:91)

The DOD organization, as recommended, is shown in Chart I. (3:60)

Now the ball was in the hands of the DOD; if they agreed with the finding of the BRDP then something had to change. Well, change they did, under the continual guidance and prodding of the then Deputy Secretary of Defense, David Packard. He began with an exchange of memos with the Service Secretaries, beginning just 13 days after the BRDP report came out. After hearing from each of the Service Secretaries, Mr. Packard directed the changes he believed necessary to satisfy the shortcomings reported by the BRDP. Then, on 13 July 1971, came DOD Directive 5000.1

with change in many areas, establishing the Defense System Acquisition Review Council (DSARC) and, importantly, requiring systems demonstration, to the extent practical, by actual performance testing prior to moving into full scale production.

This was the high level emphasis that OT&E needed and on 24 August 1971 the Deputy Director for Research and Engineering (DDR&E) issued a memo establishing a Test and Evaluation Office. Lt. General Alfred D. Starbird, USA (RET) was selected as its head. In his own words he was given

> across-the-board responsibility for the Office of the Secretary of Defense in test and evaluation matters. I was:
>
> a. To keep under surveillance all T&E policy and procedures and recommend directly to the Secretary of Defense any changes necessary.
>
> b. To monitor closely all major acquisition programs, advising the DSARC and the SecDef directly at key decision points on the adequacy of the T&E to support the Service action proposed.
>
> c. To initiate and coordinate accomplishment of such joint testing as is necessary.
>
> d. To oversee for OSD its major ranges and test facilities. (32:3)

As a result of criticism of service testing from the Congress and most likely due in part to the efforts of the late Senator Ellendar, a bill was passed directing the Services to provide the results of OT&E to the Congress.

Specifically the bill, passed November 17, 1971 states in part:

> Sec.306 (a) Beginning with the calendar year 1972, the Secretary of Defense shall submit to the Congress each calendar year, at the same time the President submits the Budget to the Congress ... a written report ... Beginning with the calendar year 1973, there shall be included in the report data on operational testing and evaluation for each such weapon system for which funds for procurement are requested (other than funds requested only for the procurement of units for operational testing and evaluation and/or long lead-time items).
>
> (b) A supplemental report shall be submitted to the Congress by the Secretary of Defense not less than thirty nor more than sixty days before the awarding of any contract or the exercising of any option in a contract for the procurement of any such weapon system (other than procurement of units for operational testing and evaluation and/or long lead-time items).
>
> (c) Any report required...shall include detailed and summarized information with respect to each weapon system covered by such report, and shall specifically include, but shall not be limited to ...the results of all operational testing and evaluation up to the time of the submission of the report, or, if operational testing and evaluation has not been conducted, a statement of the reasons therefor and the results of such other testing and evaluation as has been conducted. (23:6 &7)

The Air Force published a revision to its major test and evaluation regulation, AFR 80-14, on 12 May 1972. The major changes were to reflect the new policies developed by the Office of the Secretary of Defense (OSD) concerning the conduct of test and evaluation in the acquisition process. Specifically, it changed the categories of testing

(Former Cat I and Cat II, now DT&E. Former Cat III now OT&E) and required greater participation by the operating and supporting commands in test and evaluation.

On 17 July and 7 August 1972, two Comptroller General reports to Congress (GAO reports) were published. The first was concerned with the acquisition of major weapons systems; the second with the importance of test and evaluation in the acquisition process.

Both reports substantiated the soundness of the evolving DOD T&E policies. The first by suggesting:

> ...that DOD policies and practices regarding testing consider:
>
> --Adequate controls over granting any waivers from required testing and evaluation.
>
> --Completion of appropriate testing and evaluation prior to key decision points in the acquisition cycle. (5:35)

The latter by recommending:

> ...that DOD, in implementing its new policies and practices regarding testing and evaluation, continue to emphasize the need for:
>
> --Completion of appropriate testing and evaluation prior to key decision points in the acquisition cycle.
>
> --Adequate control over granting waivers from required testing and evaluation.
>
> --Succinct summary reports to be prepared by the testing agency for all levels of management. Interested management levels may wish to comment on these summary reports; however, they should not be permitted to change the basic summaries. (6:41)

Other government reports, such as the Report of the Commission on Government Procurement (Vol.2), also emphasized the importance of test and evaluation. Everyone was joining the chorus, singing the praises of a properly written, timely and independently conducted test program. At this point, however, the Air Force continued to tout their test centers as independent test agencies, not responsible to the System Program Offices, though a part of Systems Command. This was to change, but not just yet.

In January of 1973 DOD Directive 5000.3, "Test and Evaluation" was published, formalizing and replacing the numerous Deputy Secretary of Defense Memos (11 Feb 1971, 21 April 1971 and 3 Aug 1971) concerned with test and evaluation. This continues to be the major DOD guidance in T&E. A brief synopsis of 5000.3, as outlined by General Starbird in his 18 July 1973 statement to Congress provides an overview of the major points of this directive.

a. It stated certain principles that should apply to <u>all acquisition programs</u>. T&E would start as early as possible and be conducted in phases so as to eliminate early the risks. Acquisition schedules must be keyed to accomplishing T&E milestones before major added resource commitments were made. Prior to contracting for major production, there would be completed: sufficient development testing to insure that all design problems were identified and solutions in hand; and sufficient operational testing to provide a valid estimate of operational effectiveness and suitability.

b. OT&E would be the responsibility of a field agency independent of the developing command... Such operational testing was to be conducted in a simulated operational environment where some of the stresses of real combat operations such as fatigue and countermeasures were applied.

c. Operational testing preferably was to be separate from development testing. However, an early operational test could be combined with a development test providing: separation would cause "delay involving unacceptable military risks or unacceptable increase in systems cost"...

d. Pilot production items were to be used wherever possible for the development and operational testing completed just prior to commitment to major production. Again, however, if awaiting such pilot production would involve "unacceptable military risk or unacceptable increase in total acquisition cost" then final prototypes would be employed, but only if these prototypes were reasonably like the expected production items.

e. ...

f. The Directive included an important new provision with respect to waiving satisfactory completion of required T&E. For major programs the DCP sets forth such required T&E and only the Secretary of Defense can waive its accomplishment. For lesser programs, waiver can be granted only by the Secretary of the Military Department or his immediate subordinate designee. (32: 4 & 5)

The provisions of DODD 5000.3 which require each DOD Component have one major field agency, (or a limited number of such major field agencies) separate and distinct from the developing/procuring command, responsible for OT&E created a problem for the Air Force. As stated earlier, they considered their test centers independent. Obviously

this would not meet the requirements of DODD 5000.3. In January of this year (1974) Air Force issued a Draft Regulation (AFR 23-26) establishing and implementing the Air Force Test and Evaluation Center (AFTEC) as a separate operating agency, its commander reporting directly to the Chief of Staff Air Force (CSAF). AFTEC's organization and mission will be discussed more fully in a later section of this paper.

On 20 March of this year a Draft Revision AFR 80-14 (T&E) was issued. It incorporated changes brought about by the formation of AFTEC and details the responsibilities and interfaces of AFTEC with implementing, operating and supporting commands.

The foregoing has been a brief summary of the evolution in test and evaluation over the past four years, a most interesting history whose impact is just now being felt. Chart 2 shows the current DOD and Air Force T&E Organization. The question remains, where do we go from here?

CHRONOLOGICAL ORDER OF TEST & EVALUATION DIRECTIVES

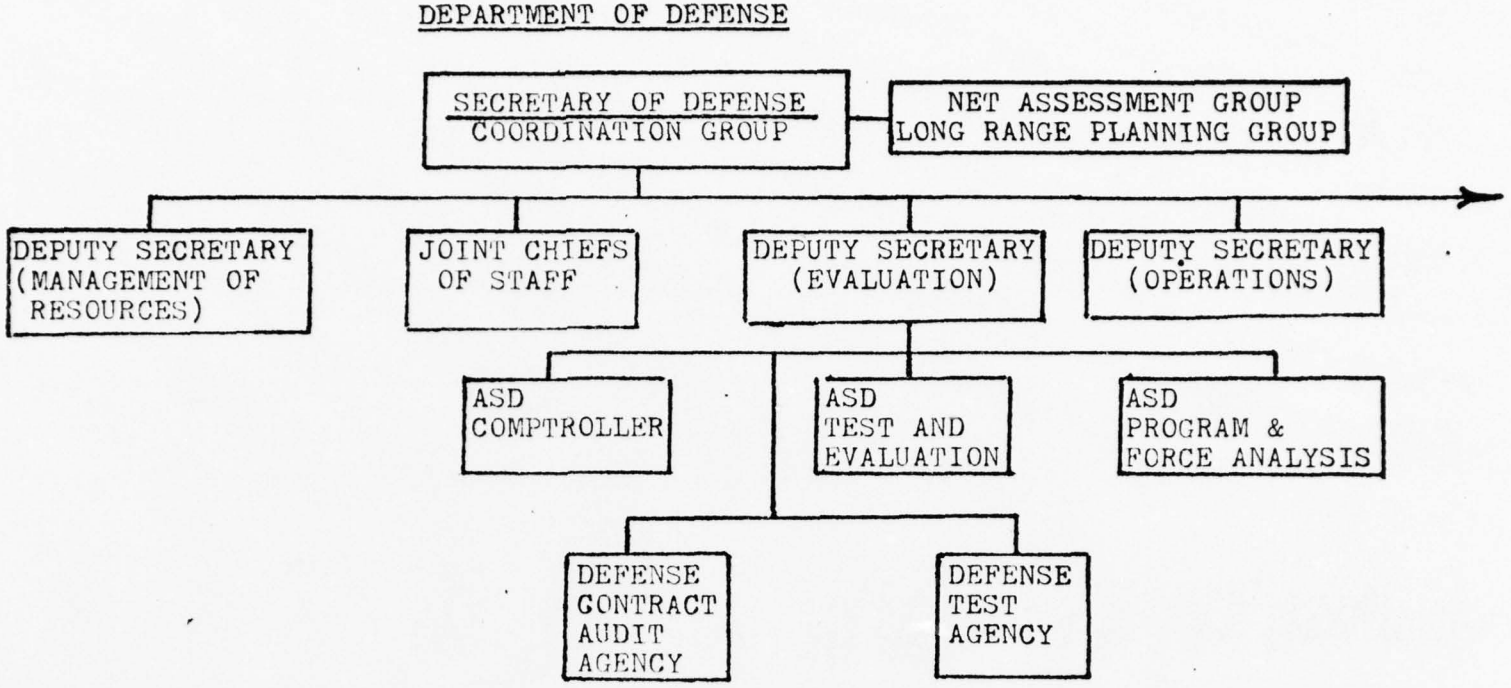
TABLE I

1970	1 July	Blue Ribbon Defense Panel Report. (3)
	July	Appendix "F" to the Blue Ribbon Defense Panel Report. (4)
	13 July	Secretary of Defense Memo to the Service Secretaries. (20)
	24 Sept	Joint Memo by the Service Secretaries to the Secretary of Defense. (16)
1971	8 Jan	Secretary of the Air Force Memo to the Secretary of Defense. (19)
	28 Jan	DDR&E "Fly Before Buy Procurement" Memo. (14)
	11 Feb	Secretary of Defense Memo, "Conduct of OT&E". (21)
	21 Apr	Deputy Secretary of Defense Memo to the Secretaries of the Military Departments. (15)
	14 May	AFSC Pamphlet 800-3. (1)
	13 July	DODD 5000.1. (11)
	3 Aug	Secretary of Defense Memo "Test and Evaluation in Systems Acquisition Process". (22)
	24 Aug	DDR&E Memo establishing the T&E Office. (17)
	17 Nov	PL-92-156 requiring OT&E reporting to Congress. (23)
1972	12 May	Air Force Reg 80-14, "Test and Evaluation"(9)
	17 July	Comptroller General Report to Congress, "Acquisition of Weapons Systems". (5)

CHRONOLOGICAL ORDER OF TEST & EVALUATION DIRECTIVES

TABLE I CONTINUED

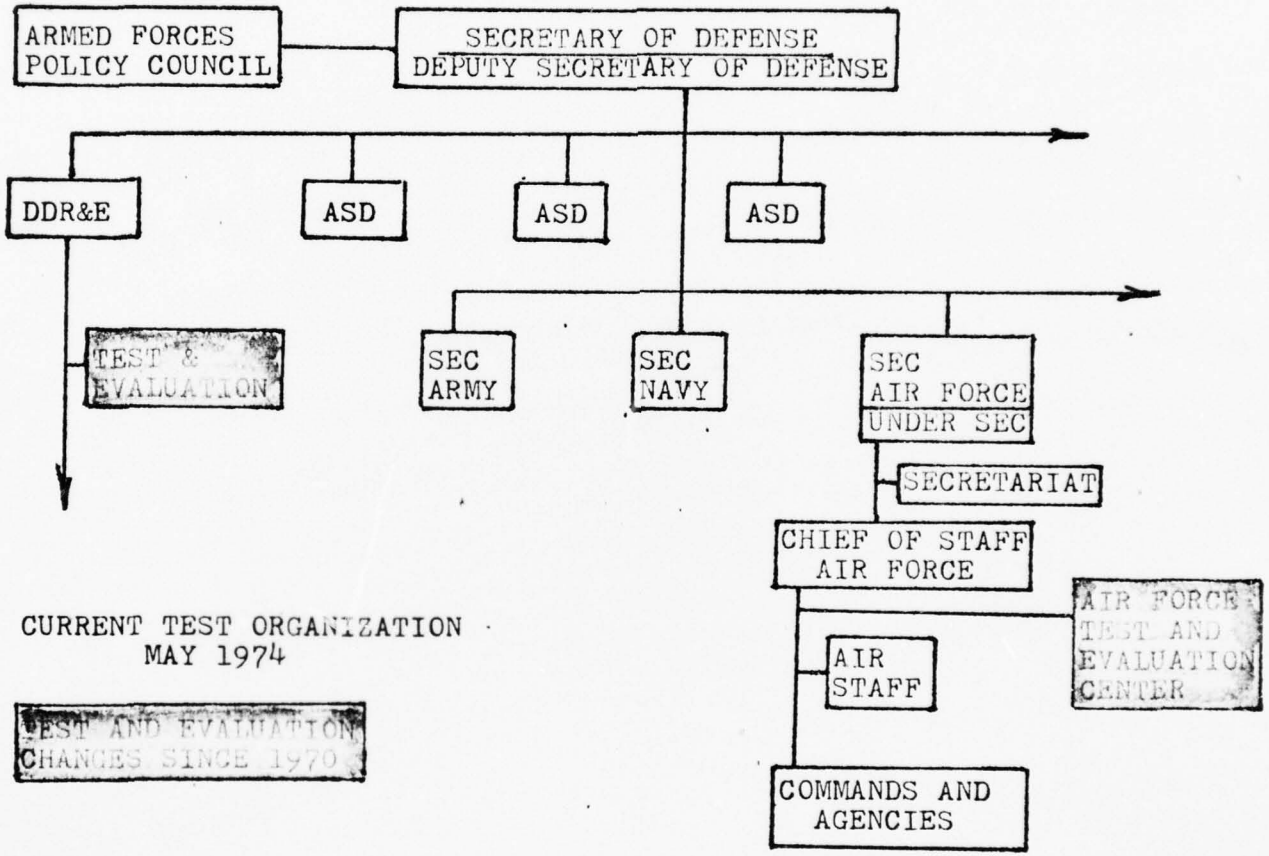
	7 Aug	Comptroller General Report to Congress, "Importance of T&E". (6)
	Dec	Report of the Commission on Government Procurement Vol. 2. (18)
1973	19 Jan	DODD 5000.3 "Test and Evaluation" (12)
	26 Mar	Comptroller General Report to the House Armed Services Committee, "Cost Growth in Major Weapons Systems". (7)
1974	1 Jan	Draft AF Reg 23-26 "AFTEC" (8)
	20 Mar	Draft Revision, Air Force Reg 80-14, "Test and Evaluation". (10)



TEST ORGANIZATION RECOMMENDED
by
BLUE RIBBON DEFENSE PANEL
July 1970

CHART I

DEPARTMENT OF DEFENSE



CURRENT TEST ORGANIZATION
MAY 1974

TEST AND EVALUATION CHANGES SINCE 1970

CHART II

INTERVIEWS

Where are we, the DOD and specifically the Air Force, going from here? What are the next steps in this test and evaluation evolution? In an attempt to get informed answers to these questions; answers that would indicate both the areas of concurrence and those yet to be fully agreed upon by the major levels in the T&E hierarchy, I prepared a short questionnaire. This provided both a standard for comparison and a point of departure for further discussion. The questionnaire used is reproduced on the next page and is followed on the next four by a brief summary of the answers received. Those interviewed were:

1. Rear Admiral Forrest S. Petersen, Assistant Director (Strategic & Support Systems Test and Evaluation), ODDR&E.
2. Lt Colonel James Martin, Hq. Air Force/AFRDPQ.
3. Colonel Max Findell, HqAFSC/DOVM.
4. Major Larry Griffin, AFTEC/TET.

Expanded answers and an analysis of this and related information will be found in the next section of this paper.

QUESTIONNAIRE

1. Will each program require a testing phase prior to its production go-ahead? (If not, is the dollar criteria the same as for DSARC?)
2. Is this testing what is now called OT&E or IOT&E?
3. How autonomous should the Air Force OT&E test activity be? (To what level should the activity report?)
4. What organization funds the independent OT&E agency?
5. What role will the newly-formed AFTEC play in aircraft OT&E?
6. Who will prepare the OT&E test plan (for major aircraft systems)?
7. How will crew members be selected to fly the OT&E flight test plan?
8. Who will prepare the OT&E test report?
9. Where does it go?
10. Are there any major systems that would have been cancelled if OT&E had been completed prior to the beginning of the production phase?

Answers provided by Rear Admiral Peterson (DDR&E)

1. Yes - for all major programs and at least in principle for those less than major.
2. The testing prior to production go-ahead is IOT&E.
3. To the Chief of Staff Air Force.
4. It will be shared by AFSC, AFTEC and the user.
5. Primarily they will manage the test.
6. AFTEC
7. From the using command TDY to AFTEC.
8. AFTEC
9. Directly to the Chief of Staff Air Force with copies to all interested commands.
10. No

Answers provided by Lt Colonel Martin (Hq Air Force)

1. Each program will have a test plan; testing can be waived per DODD 5000.3.

2. IOT&E, testing conducted prior to the production go-ahead. DT&E data, when reviewed by the user, can be a portion, or even all, of IOT&E.

3. Should report to the Chief of Staff Air Force.

4. This is an item in the Air Force budget.

5. AFTEC will manage overall IOT&E as well as OT&E programs.

6. AFTEC, with inputs from the users.

7. Using command, to criteria set by AFTEC.

8. Inputs given by the test team, evaluated by AFTEC.

9. Directly to the Chief of Staff Air Force with copies to the implementing, operating and supporting commands. DDR&E (T&E) has access to all reports.

10. The B-58.

Answers provided by Colonel Findell (HqAFSC)

1. Yes

2. IOT&E

3. There is a dispersion of OT&E responsibility between AFTEC and the operating commands. AFTEC reports to the Chief of Staff Air Force directly.

4. IOT&E primarily by AFSC, OT&E by the operating commands.

5. AFTEC may manage all T&E or may monitor just IOT&E.

6. The test centers will be responsible for detailed test planning.

7. They will come from the operating command.

8. Combined AFTEC and operating command effort.

9. To the Chief of Staff Air Force with copies to all interested parties.

10. Probably. (None named)

Answers provided by Major Griffin (AFTEC)

1. Yes, as required by DODD 5000.3 and AFR 80-14.

2. That is what we call IOT&E.

3. A very autonomous operation, reporting directly to the Chief of Staff Air Force.

4. The developing and using commands; their share depends on the type of test.

5. It will be as required, providing the test conductor, test manager or test monitor, depending in part on AFTEC's capability.

6. Either the PMD or the Test Director out of Hq Air Force will deliniate who will prepare the test plan.

7. Some will be from AFTEC, primarily on component testing, primarily they will come from the operating command.

8. The Test Director, either from AFTEC or the command doing the test. All will go through AFTEC for review.

9. To AFTEC for review and a Commander's Summary. It will then go directly to the Chief of Staff Air Force with no changes in the original report.

10. The C-5 would have been changed, but not cancelled.

ANALYSIS OF INTERVIEWS AND RELATED INFORMATION

The interviews reported here are surprising in only one respect - they were in almost total agreement. Where they differ is in the degree of involvement of AFTEC in test and evaluation. Looking at each question I find a consensus as follows:

1. Each and every program will require a testing phase prior to its production go-ahead. In rare cases the test requirements can be waived, by the Chief of Staff Air Force for less than major programs, and by OSD for major programs.

2. The current name for the testing accomplished specifically to assist in making the DSARC III, production go-ahead decision, is Initial Operational Test and Evaluation (IOT&E).

3. The question of autonomy was answered in each case by pointing out that the test agency should report directly to the Chief of Staff Air Force.

4. At this point in time the understanding is that test and evaluation funding will be shared by the developing and operating commands, with AFSC primarily funding IOT&E and the operating command primarily funding OT&E.

5. AFTEC will provide a management role in Air Force T&E. It is interesting to note that the AFTEC response to

this question expanded on the management role and included the probability of active flying participation.

6. AFTEC will have final approval on the adequacy of test plans; however, the actual preparation will likely be by combining inputs from all concerned parties.

7. Crew members for aircraft IOT&E and OT&E flight tests will come from the operating command with the possibility of some from AFTEC.

8. All test reports will be prepared by the test director, usually from AFTEC; however, he could be from the operating command. In every instance the report will be reviewed by AFTEC and a Commander's Summary will be attached. The original report will not be changed.

9. All reports will be sent directly to the Chief of Staff Air Force with copies to the implementing, operating and supporting commands.

10. Opinions varied; however, all agreed that while program cancellation may not have been the result of current T&E policies being applied to past programs, significant changes to programs such as the C-5 and B-58 would have been required.

Colonel James Abrahamson, former Maverick SPO Director (currently the Systems Command Inspector General), has a unique insight to the evolving test and evaluation policies.

During his tenure as Maverick Director, that program was selected by DDR&E as the first program to have its full production go-ahead delayed pending an in-depth operational test program. DDR&E wanted an independent evaluation, the goal of the emerging guidance, and at this time the Air Force did not have what they consider to be an independent test agency. They went to other government agencies such as Weapons Systems Evaluation Group (WSEG) and Institute for Defense Analysis (IDA) for test direction. The Air Force gave money to DDR&E to buy test equipment and instrumentation. The Maverick Program Office provided both the modified delivery aircraft and Maverick missiles to be tested. The test plan would not allow AFSC pilots to fly the test program, so additional time and funds were required to train TAC pilots to fly the test plan. Major emphasis was placed on a realistic test environment and joint testing. The test results were further evaluated by analyzing the results in simulation against a European weather environment.

Colonel Abrahamson views this as an example of how AFTEC will operate, drawing resources from the implementing and operating commands and providing overall test management and an independent evaluation directly to the Chief of Staff Air Force and OSD at their request.

It is important to note at this point that there is great concern within the implementing command that the current test and evaluation policies will cause major program cost increases by enforcing a delay between full scale development and production. This concern has been the topic of a major study effort undertaken by the Aeronautical Systems Division of AFSC under the direction of Lt General James Stewart.

The central question is the balance between what adequate testing saves in future program costs and the increased costs incurred by causing a contractor to slow down or stop his manufacturing effort while IOT&E is conducted. This subject is treated in an individual study paper written by Lt Colonel G. Kline, titled "The Penalty of an Extreme Incremental Acquisition Strategy". Further information in this area can also be found by referring to the ASD study mentioned above. (24)

The role of AFTEC is best described by its mission statement as follows:

> AFTEC's mission is to manage the Air Force's Operational Test and Evaluation (OT&E) program. AFTEC assesses the military utility of major and HQ USAF-designated non-major Air Force systems. Major commands (MAJCOMS) support AFTEC as directed by HQ USAF program management directives (PMDs) or test directives (TDs). AFTEC recommends Air Force OT&E policy to HQ USAF for approval as well as plans, directs, controls, evaluates, and reports--independently--on OT&E. AFTEC serves as the

> principal field command for providing OT&E information to the Secretary of the Air Force (SAF) and the Chief of Staff of the Air Force (CSAF) in preparation for Defense Systems Acquisition Review Council (DSARC) actions and to support those Air Force procurement requests for which OT&E information is statutorily required to be supplied to the Congress. (8:1)

As to the future a recent high level speaker at the Defense Systems Management School, when questioned about further implementation of the BRDP recommendations in the test and evaluation area, stated that OSD would probably support a gradual expansion of General Starbird's test and evaluation role in systems acquisition; however, to support a major change is doubtful and would probably not be supported. This is also a general consensus of those I have talked with regarding the future direction of test and evaluation policy. The current policies, when fully implemented will be stable for some years to come. They will continue to provide the confidence we seek in a new weapon system prior to a full production commitment.

CONCLUSIONS

The single overriding message to come out of the test and evaluation evolution is that any new acquisition program must be capable of meeting or exceeding the real world goals expected of it in the actual or closely simulated operational environment prior to any major production commitment. The evolution which began just four years ago should convince even the most skeptical among us that the "show me" attitude is firmly entrenched from Congress (as evidenced by PL-92-156) down through the Office of the Secretary of Defense (per DODD 5000.1 and 5000.3) to each level in the review and approval chain. There is the ever present danger of over-reaction to changing guidance. Large increases in program costs due to a production gap during conduct of IOT&E are a major concern if such over reaction should occur. I questioned many people at each level of the T&E community from OSD to AFTEC and found an acute awareness of the potential dangers in an overly restrictive test environment.

Still there remain two distinct camps; one convinced that initial operational testing must come before any production release, the second equally convinced that limited production commitments are necessary to keep the contractors' production and engineering staffs usefully occupied while awaiting completion of IOT&E and the production decision.

The first camp seems to have won the latest round, as Congress deleted the fourth B-1 production money from DOD's 1975 supplemental funding bill. This fourth aircraft had been requested by the Air Force and DOD specifically to keep the North American Rockwell production facility occupied while ICT&E was being accomplished. The fact that a fourth aircraft was even included in the DOD supplemental funding request shows some change in thinking at the OSD level.

The test and evaluation evolution we are witnessing today is not unlike the wave of consumerism which has been sweeping our country for the past several years. The motivations are the same - Congress, representing the people of our country is tired of buying systems which cost too much and won't perform as advertised. Therefore, in addition to continuing emphasis on program cost and schedule considerations, test and evaluation must take on new importance. In the past it has been an area to trade off for dollar or schedule savings. The contrary is true today, with additions to the planned test program not uncommon (as evidenced by the Maverick program).

Recommendations - Each program office must:

1. Track the current laws, directives and regulations concerning test and evaluation, to assess and prepare for the impact on their program.

2. Provide detailed planning for all testing phases (DT&E, IOT&E and OT&E) early in its program life cycle.

3. Include all concerned commands and agencies in all the planning phases.

4. Construct, with the aid of AFTEC and other concerned parties, a test plan which will provide convincing proof that its system will do the mission it is designed to do, and do it in its operational environment.

5. Assure that sufficient numbers of its system are designed into its full scale development program to keep the contractors' production and engineering personnel intact until IOT&E is complete and the production decision is made.

The name of the game today is thorough testing and independent evaluation. T&E is the final selling point of each program. A good test program will not sell a bad system, but a poorly-designed test program could kill an otherwise good system. With proper attention to test and evaluation planning, the proving of a system's worth should progress as smoothly as the acceptance of Aeroplane No. 1.

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APPENDIX A

GLOSSARY OF TERMS

ACCEPTANCE TESTS. Those tests performed to demonstrate that a specific lot of articles that has been manufactured will perform within the tolerances and over the range of operational and environmental criteria specified for the article.

ACQUISITION LIFE CYCLE. Normally, it consists of five phases; (Conceptual, Validation, Full Scale Development, Production and Deployment) with decision points between each of the first four phases (Program, Ratification, and Production Decisions).

DEVELOPMENT TEST AND EVALUATION (DT&E). Test and Evaluation which focuses on the technological and engineering aspects of the system, subsystem, or equipment items.

EVALUATION. The review and analysis of qualitative or quantitative data produced during current or previous testing, or operational usage, or combination thereof.

IMPLEMENTING/DEVELOPING COMMAND. The command responsible for the acquisition of the system, subsystem, or item of equipment.

LOGISTICS SUPPORTABILITY. How well the composite of support considerations necessary to achieve the effective and economical support of a system or equipment for its life cycle meets stated quantitative and qualitative requirements.

OPERATIONAL TEST AND EVALUATION (OT&E). Test and Evaluation which focuses on the development of optimum tactics, techniques, and concepts for systems and equipment, and evaluation of reliability, maintainability, and operational effectiveness and suitability of systems and equipment under realistic operational conditions.

(1) INITIAL OPERATIONAL TEST AND EVALUATION (IOT&E). That OT&E to be accomplished prior to the first major production decision to determine operational effectiveness, suitability and logistic supportability.

(2) FOLLOW-ON OPERATIONAL TEST AND EVALUATION. That OT&E accomplished subsequent to IOT&E or receipt of production items.

OPERATING COMMAND. The command primarily responsible for the operational employment of a system, subsystem, or item of equipment. This term generally applies to those operational commands or organizations designated by HQ USAF to conduct or participate in operations or operational testing.

OPERATIONAL EFFECTIVENESS. How well the system performs in its intended environment including countermeasures.

OPERATIONAL SUITABILITY. How well the system is suited to be operated and maintained by military personnel in the field.

PRODUCTION ACCEPTANCE TEST AND EVALUATION (PAT&E). Test and evaluation of production items to demonstrate that the items procured fulfill the requirements and specifications of the procuring contract or agreements PAT&E continues throughout the production phase of the acquisition process.

PROGRAM MANAGER. The single Air Force manager during any specific phase of the acquisition life cycle (System Program Director, Program Manager, or System Manager/ Item Manager).

PROGRAM OFFICE. The field office organized by the Program Manager to assist him in accomplishing the program tasks.

QUALIFICATION TESTS. Those tests that verify the design and manufacturing process and thus provide a baseline for subsequent acceptance tests. Qualification testing is conducted to accomplish two separate functions:

(1) Environmental tolerance of design (Preproduction Qualification Tests). A series of formal contractual tests are conducted to insure design integrity over the specified operational and environmental range. The test should be conducted on prototype or preproduction hardware fabricated to the proposed production design specifications and drawings. These tests are a constraint to production release on programs which involve volume acquisition.

(2) Manufacturing process verification (Production Qualification Tests). A series of formal contractual tests are conducted to insure the effectiveness of the manufacturing process, equipment, and procedures. These tests should be conducted on a sample taken at random from the first production lot, and should be repeated if the process is changed significantly and when a second or alternate source is brought on line.

SUPPORTING COMMAND. A command that provides direct support to a system or test program. Normally refers to AFLC, USAFSS, and ATC in their role as logistics support and training organizations.

TEST. Any program or procedure which is designed to obtain, verify, or provide data for the evaluation of: research and development (other than laboratory experiments); progress in accomplishing development objectives; or performance and operational capability of systems, subsystems, components, and equipment items.

TEST DIRECTOR. A person assigned to plan and direct test and evaluation at a test site.

TEST PLAN. A management document which describes how and when specified test objectives will be met.